Plant Archives Vol. 25, Supplement 1, 2025 pp. 1858-1862 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org
DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2025.v25.supplement-1.254

EFFECT OF BIO-FERTILIZERS AND INORGANIC MANURES ON VEGETATIVE PARAMETER OF CHINA ASTER (*CALLISTEPHUS CHINENSIS* L. NEES) CV. KAMINI

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(Date of Receiving : 16-09-2024; Date of Acceptance : 22-11-2024)

ABSTRACT

The present investigation the effect of bio-fertilizers and inorganic manures on vegetative parameter of China aster (*Callistephus chinensis* L. Nees) cv. Kamini under at Horticultural Research Farm, Department of floriculture and Landscape Architecture, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G) during the year 2019-2020 in Rabi period. The experiment was laid out in a Randomized Block Design with eleven treatments with three replications. The results indicate that the vegetative parameter viz., plant height (cm), number of primary branches per plant, number of secondary branches per plant, number of leaves per plant and plant spread (cm) of china aster were significantly influenced by the different bio-fertilizers and inorganic manures. The results revealed that maximum vegetative parameter was recorded at the application of T_8 - 75% RDF + 25% FYM + PSB + Azotobacter followed by T_9 - 75% RDF + 25% Vermicompost + PSB + Azotobacter. While the minimum was observed under T_0 100% RDF (Control).
***Keywords* :** Vermicompost, Azotobacter, China aster and bio-fertilizers.

Introduction

China aster [*Callistephus chinensis* (L). Nees] belongs to one of the largest families of flowering plants, 'Asteraceae'. It's diploid (2n) chromosome number is 18 (Huziwara, 1954). The genus *Callistephus* has only a single species *Callistephus chinensis*. Linnaeus named it *After chinensis* at first, but it was renamed to *Callistephus chinensis* by Nees. The single species chinensis belong to the genus Callistephus (Munikrishnappa and Chandrasheker, 2014). The name Callistephus is derivative from two Greek words: Kalistos, which means most attractive and Stephus, which means crown. It symbolizes purity, love, peace, beauty and passion (Naikwad *et al*., 2018). The colours are varied, including natural pink shades of white, pink, primrose, light blue, lavender, fuchsia, purple, dark blue and scarlet. Kamini variety was derived by crossing two pure lines (AST 6 x AST- 36) and was developed through pedigree method of breeding with the intent of obtaining pink coloured flowering variety for cut flower purpose, which is exceptional to the Local Pink variety.

It is native to China has spread to Europe and other tropical countries during 1731 A.D. (Desai, 1967). It is also an important flower crop of Siberia, USSR, Japan, North America, Switzerland and Europe. It is grown successfully in open conditions for year-round production in kharif, rabi and summer to have continuous supply of flowers to the market. It is one of the most important annual flower crops grown in most parts of the world. Aster is a winter seasonal annual flower crop that is half-hardy; free blooming and easy to grow. The plant is erect with leaves are arranged alternately on branches and bear solitary type of flower (Bohra *et al*., 2019).

Biofertilizer maintains living cells or latent cells of effective microbial strains. When they are spread through nucleoli or dirt, they help crops absorb nutrients through cooperation in the rhizosphere. They promote the active development of microorganisms in the soil, thereby supplementing the range of nutrient availability in a form that plants can easily adapt. The production of qualified nominated microorganisms with dramatic reproduction is a powerful part of promoting the growth of microorganisms in the soil. A stable fixed nitrogen source is a mandatory prerequisite for sustainable biomass production in the ecology of the entire continent. Because it will inevitably die in the entire soil, some external supply of nitrogen is repeatedly required to maintain long-term productivity. Otherwise, soil nitrogen fixation reserves will slowly decline until the biomass productivity is reduced. The farthest part of the spreading phosphorus stays still in the soil and quickly transforms into something that plant approval cannot reach. In order to accumulate soil nutrient reserves, we increase chemical fertilizers to satisfy the nutritious food of plants.

Materials and Methods

The experiment was conducted in the Horticultural Research Farm, Department of Horticulture and landscape architecture, College of Agriculture, IGKV, Raipur, (C.G.) during Rabi season of the year 2019-20. The experiment was conducted on China aster with eleven treatment and three replications in Randomized Block Design. The total number of plants per plot 35 were space at 30 cm x 30 cm. The seeds of China aster cv. Kamini were sown in pro-trays and kept in germination chamber for proper germination.

Treatment combinations

S. No.	Treatments	Notations to be used
1.	100% RDF (Control)	T_1
2.	75% RDF + PSB + Azotobacter	T_2
3.	50% RDF + PSB + Azotobacter	T_3
4.	75% RDF + 25% FYM	T_4
5.	50% RDF + 50% FYM	T_5
6.	75% RDF + 25% Vermicompost	T_6
7.	50% RDF + 50% Vermicompost	T_7
8.	75% RDF + 25% FYM + PSB + Azotobacter	T_8
9.	75% RDF + 25% Vermicompost + PSB+ Azotobacter	T_9
10.	50% RDF + 50% Vermicompost + PSB+ Azotobacter	T_{10}
11.	50% RDF + 50% FYM+ PSB + Azotobacter	T_{11}

Result and Discussion

Plant height (cm)

Effect of bio-fertilizers and inorganic manures on the plant height (cm) after analysis the data presented in Table.1 refer that 30 days after planting the superior height of the plant (5.80 cm) was noted in treatment T_8 (75% RDF + 25% FYM + PSB + *Azotobacter*) which shows that other treatments like T_4, T_6, T_7, T_9, and T_{11} were statistically comparable whereas, it shows consequent difference with treatment T_1, T_2, T_3, T_5 and T_{10}. The marginal plant height (4.20 cm) was observed in T_1 (100% RDF control). After 50 DAP the plant height reached to maximum (9.50 cm) were found in treatment T_8 (75% RDF + 25% FYM + PSB + *Azotobacter*) which was statistically similar with the treatments like T_6, T_9, T_{10}, and T_{11}. Whereas, there was significant difference with treatment T_1, T_2, T_3, T_4, T_5 and T_7. The marginal plant height (7.00 cm) was observed in T_1 (100% RDF control). In case of 70 DAP the highest plant height (15.70 cm) was recorded in treatment T_8 (75% RDF + 25% FYM + PSB + *Azotobacter*). Whereas, it was statistically *at par* with the treatment T_9. However, it showed undoudtably superior to rest of all other treatments.

The probable inference for increases in plant height may be because of united function of organic and biofertilizer with 75% of RDF resulted in improved nutrient which helps to escalation photosynthesis activity, improved division of cell and amplification. Nucleic acid in which nitrogen is imperative constituent that raises the production of amino acid, carbohydrates etc. from which auxins, gibberellins, cytokines like phytohormones have been produced. Whereas, in protoplasm and chlorophyll phosphorus is crucial constituent, caused change of photosynthates into phospholipids which is subsequent in suitable vegetative development thus tallest plant. Numerous growths encouraging phytohormones (auxins, cytokinin and gibberellins etc.) where produce biofertilizers which accumulate the accessibility of nitrogen and phosphorus in the plants gives healthier growth of the plants. Comparable outcomes were also stated by Chaitra and Patil (2007), Patil and Agasimani (2013) and Kirar *et al*. (2014) in China aster; Airadevi (2012) in annual chrysanthemum.

Number of primary branches per plant

Effect of bio-fertilizers and inorganic manures on number of primary branches per plant after analysis the data presented in Table.1 refers that by the application of different doses of NPK and biofertilizer in combination affect the primary branch number. The results showed that the maximum primary branches each plant (12.50) was noted with the treatment T_8 (75% RDF + 25% FYM + PSB + *Azotobacter*) which was found similar with treatment T_9 (75% RDF + 25% Vermicompost PSB + *Azotobacter).* Whereas, it was found significant differences with rest of the other treatment. The minimum number of primary branches (4.30) was found in T_1 (100% RDF control).

Fixation of nitrogen and production of growth encouraging materials like indole acetic acid and gibberellins which increase the branches number in each plant. The outcomes are add in with finding of Chaitra and Patil (2007) who reported that maximum count of primary branches per plant with inoculation of *Azotobacter* and PSB in China Aster.

Number of secondary branches per plant

Effect of bio-fertilizers and inorganic manures on number of secondary branches per plant after analysis the data presented in Table.1 refers that by the applying the different doses of NPK, organic manure and biofertilizer with or without combinations affect the secondary branches number. The highest number of secondary branches per plant (14.50) was obtained with treatment T_8 (75% RDF+25% FYM+ PSB +*Azotobacter*) which was showed *at par* with treatment T_9 (75% RDF +25% Vermicompost +PSB +*Azotobacter).* However, it was exhibited significant difference with rest other treatments. "The marginal number of auxiliary branches (9.10) were found in T_1 (100% RDF control).

Correspondingly, with the treatment T_8 there is increase in the secondary branches number is due to cell division and enlargement because of the formation if nitrogenous components. Structural components in phospholipids and in food translocation phosphorous play crucial role. Fixation of nitrogen and production of growth encouraging materials like indole acetic acid and gibberellins which increase the branches number in each plant. Same result found in increased in flowering branches number reported by Chaitra and Patil (2007), Patil and Agasimani (2013) in China aster; Gupta *et al.* (1999) and Kumar *et al.* (2009) in African marigold; Verma *et al.* (2011) in chrysanthemum.

Number of leaves per plant

Considerable differences regarding plant height were found among the treatments, after analysis the data presented in (Table.2) refer that 30 days after transplanting there is increase in leaves number (7.10) was noted in treatment T_8 (75% RDF+25% FYM+ PSB + *Azotobacter*) which shows that other treatments like T_7, and T_9 (6.20, 6.90) were statistically comparable. Whereas, it shows consequent difference with other treatments. The marginal plant height (4.01cm) were observed in T_1 (100% RDF control). After 50 DAT the highest leaves number per plant (13.10) were found in treatment T_8 (75% RDF+25% FYM+ PSB + *Azotobacter*) which was statistically similar with the treatments T_{10} (50% RDF+50% vermicompost+PSB+*Azotobacter*). Whereas, it was significantly difference with other treatments. The marginal leaves numbers (7.50) per plant were observed in T_1 (100% RDF control). In case of 70 DAT the highest leaves numbers (29) was recorded in treatment T_8 (75% RDF+25% FYM+ PSB + *Azotobacter*). Whereas, it was statistically *at par* with the treatment T_9 and T_{10}. Whereas, it was significantly difference with other treatments. The marginal leaves numbers (20.20) were observed in T_1 (100% RDF control).

Increase in leaves number per plant is due to collective application of chemical manure and organic manure with *Azotobacter* and PSB which divide and amplify the cells. These outcomes are accordance a*t par* with the findings of Kirar *et al.* (2014) in China Aster cv. 'Princess'. Kumar *et al.* (2009) and Gupta *et al.* (1999) reported in marigold.

Plant spread (cm)

The data on plant spread of china aster are presented in Table 2. shows that the superior plant spread (23.70 cm) was noticed in treatment T_9 (75% RDF + 25% Vermicompost + PSB +*Azotobacter*) which was statistically *at par* with T_8 and T_{10}. Whereas, it was showed significant variation with the others treatment. The lowest plant spread (13.80cm) was noticed in T_1 (100% RDF control).

Biofertilizers viz. *Azotobacter* and phosphorous solubilizing bacteria verified to be advantageous as they bond the atmospheric nitrogen and mobilize immobile phosphorus in soil and correspondingly release growth encouraging material like auxins, which inducement the metabolic movements in the plant. Above results are in conformity with the findings of Panchal *et al.* (2010) in annual chrysanthemum.

Table 1: Effect of bio-fertilizers and inorganic manures on vegetative parameter of China aster (*Callistephus chinensis* L. Nees) cv. Kamini

Treatments	Plant height (cm)			Number of primary branches	Number of secondary branches
	30 DAP	30 DAP	30 DAP		
T_1 - 100% RDF (Control)	4.20	7.00	11.00	4.30	9.10
T_2 - - 75% RDF + PSB + Azotobacter	5.00	8.50	13.90	7.70	11.00
T_3 - 50% RDF + PSB + Azotobacter	4.80	7.90	13.30	9.50	12.00
T_4 - 75% RDF + 25% FYM	5.20	7.80	13.80	8.70	11.10
T_5 - 50% RDF + 50% FYM	5.00	8.30	13.90	6.50	10.90
T_6 - 75% RDF + 25% Vermicompost	5.20	8.70	12.70	9.70	11.60
T_7 - 50% RDF + 50% Vermicompost	5.30	8.30	12.60	8.80	11.60
T_8 - 75% RDF + 25% FYM + PSB + Azotobacter	5.80	9.50	15.70	12.50	14.50
T_9 .75% RDF + 25% Vermicompost + PSB+ Azotobacter	5.40	9.10	14.50	11.50	13.00
T_{10} - 50% RDF + 50% Vermicompost + PSB+ Azotobacter	4.70	9.00	13.70	9.10	11.70
T_{11} - 50% RDF + 50% FYM+ PSB + Azotobacter	5.40	9.10	13.40	8.50	10.90
SEm±	**0.20**	**0.32**	**0.47**	**1.21**	**0.60**
CD at 5% level	**0.61**	**0.97**	**1.40**	**3.59**	**1.80**

Table 2 : Effect of bio-fertilizers and inorganic manures on vegetative parameter of China aster (*Callistephus chinensis* L. Nees) cv. Kamini

Treatments	Number of leaves			Plant Spread (cm)
	30 DAP	30 DAP	30 DAP	
T_1 - 100% RDF (Control)	4.01	7.50	20.20	13.80
T_2 - - 75% RDF + PSB + Azotobacter	5.20	10.30	22.50	16.30
T_3 - 50% RDF + PSB + Azotobacter	5.40	9.70	25.20	17.90
T_4 - 75% RDF + 25% FYM	5.70	9.70	25.20	19.00
T_5 - 50% RDF + 50% FYM	5.40	10.40	23.80	16.00
T_6 - 75% RDF + 25% Vermicompost	5.10	9.30	24.30	19.00
T_7 - 50% RDF + 50% Vermicompost	6.20	10.40	24.30	16.20
T_8 - 75% RDF + 25% FYM + PSB + Azotobacter	7.10	13.10	29.50	21.70
T_9 .75% RDF + 25% Vermicompost + PSB+ Azotobacter	6.90	10.50	26.30	23.70
T_{10} .50% RDF + 50% Vermicompost + PSB+ Azotobacter	5.80	11.30	26.50	21.70
T_{11} .50% RDF + 50% FYM+ PSB + Azotobacter	5.70	9.40	24.80	15.20
SEm±	**0.34**	**0.63**	**1.11**	**0.70**
CD at 5% level	**1.02**	**1.88**	**3.30**	**2.06**

Conclusion

The results of the present investigation revealed that the nutritional requirement of china aster could be fulfilled with the exclusive use of different bio-fertilizers and inorganic manures on vegetative character of china aster. The majority of the vegetative growth characteristics of plants, including plant height, leaf count per plant, primary and secondary branch count, and plant spread, were found to respond best to treatment T_8 (75% RDF + 25% FYM + PSB + Azotobacter) followed by T_9 - 75% RDF + 25% Vermicompost + PSB+ Azotobacter.

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